National Institute of Environmental Health Sciences

Modeling the impact of climate change on runoff and annual water balance of an Arctic headwater basin

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Abstract:

Climate change will be an important issue facing Arctic areas in the coming decades since climate models are projecting warmer and wetter conditions for many northern regions. From a hydrological perspective, critical issues include a shortened snow cover season, changes in winter snow cover properties, and changes in the timing and volume of snowmelt runoff. To assess the impacts of projected temperature and precipitation changes on the hydrology of a small Arctic headwater basin, the distributed hydrological model WATFLOOD was used in conjunction with selected Global Circulation Models (GCMs) and future climate scenarios. It was found that the hydrological model simulated basin runoff adequately either with input climate data collected in the study area or with input data from a long-term climate station located approximately 50 km south. WATFLOOD was then used to predict future runoff using GCM outputs for the 2040-69 and 2070-99 time periods. The results gave dates of first and peak runoff that were, on average, up to 25 days earlier than in current (1961-90) climate. In addition, future runoff and evaporation volumes increased by up to 48% as a result of projected increases in temperature and precipitation. Furthermore, a large number of simulated years showed midwinter melt periods, which will have major impacts on snowpack properties and, in turn, on human, animal, and plant life in this region.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES)

Special Report on Emissions Scenarios (SRES) Scenario: SRES A2, SRES B2

Exposure :

weather or climate related pathway by which climate change affects health

Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

Arctic

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Non-U.S. North America

Health Impact:

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Mitigation

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Long-Term (>50 years)

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content